Case Report

Treatment strategy for a penetrating stab wound to the vertebral artery: a case report

Shinya Yaguchi,[1] Hitoshi Yamamura,[1] Kousuke Kamata,[1] Norihito Shimamura,[2] Shinya Kakehata,[3] and Atsushi Matsubara[4]

[1]Department of Disaster and Critical Care Medicine, [2]Department of Neurosurgery, [3]Department of Radiation and Radiation Oncology, and [4]Department of Otorhinolaryngology, School of Medicine, Hirosaki University, Hirosaki, Aomori, Japan

Case: Vertebral artery injury is a low-frequency but high-mortality injury. The surgical approach to a bleeding vertebral artery injury is one of the most difficult procedures in trauma surgery.
A 64-year-old woman was transported to our emergency department after being stabbed in the middle side of the right neck with a large kitchen knife. Her initial hospital examination indicated a shock state, and computed tomography images revealed a right vertebral artery injury. We undertook angiography and transcatheter arterial embolization before the surgical operation.

Outcome: The patient suffered right upper extremity paralysis due to brachial plexus injury and was transferred to another hospital for rehabilitation on the 24th hospital day.

Conclusion: Computed tomography angiography for diagnosis and interventional radiology treatment are useful for the management of penetrating neck trauma. Transcatheter arterial embolization for vertebral artery injury is safe and allows for easy control of bleeding compared to a surgical procedure.

Key words: Computed tomography angiography, penetrating stab injury, root injury, transcatheter arterial embolization, vertebral artery injury

INTRODUCTION

THE FREQUENCY OF vertebral artery injury is low because, anatomically, the artery hides within the cervical vertebrae, but it is a high-mortality injury.[1] A previous report indicated that the mortality rate ranged from 3% to 19%.[2] However, with the development of computed tomography (CT) diagnosis and angiography procedures, the mortality rate has recently improved. In particular, the surgical approach to a bleeding vertebral artery is one of the most difficult procedures in trauma surgery because of the artery's anatomical characteristics.[3] We report our treatment of a neck stab wound of the vertebral artery by a kitchen knife and discuss treatment strategies and management of this condition.

Corresponding: Hitoshi Yamamura, MD, Department of Disaster and Critical Care Medicine, Hirosaki University, School of Medicine, 5 Zaifuchou, Hirosaki, Aomori 036-8562, Japan. E-mail: yamamura@hirosaki-u.ac.jp.
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CASE

A 64 -YEAR-OLD WOMAN was brought to our department after being stabbed in the middle side of the right neck with a large kitchen knife with a blade length of 20 cm after a quarrel with a lodger. Emergency medical services transported the patient on oxygen and with i.v. administration of 600 mL crystalloid, and she arrived at our hospital 101 min after the incident. Her initial hospital care was in line with the Japan Advanced Trauma Evaluation and Care guidelines, and her initial examination indicated a shock state with a respiratory rate of 24 breaths/min, heart rate of 121 b.p.m., blood pressure of 82/40 mmHg, and body temperature of 35.0°C. Arterial blood gas analysis showed a pH of 7.336, base excess of −15.9, and lactate of 11.4 mmol/L. The patient's Glasgow Coma Scale score was 5 (E1V3M1). After the initial examination, the Glasgow Coma Scale rose to 8 (E1V3M4), and no paralysis of her right arm was present. The initial pupil findings were

r/l = 4.0/4.0, and light reflex was prompt in both. She had a medical history of diabetes mellitus and atrial fibrillation. We immediately carried out massive transfusion protocol and transfused 6 units of type O red blood cells, 4 units of fresh frozen plasma, and tranexamic acid. A stab wound was present in the zone I area on the middle of the right neck over the sternocleidomastoid. There was no active bleeding from the wound. After stabilization, we used CT to search for injuries to major vessels. Computed tomography showed an obstruction of the right vertebral artery at the C7 level without extravasation and did not reveal any injury to the right common carotid artery or jugular vein (Fig. 1). Because the patient required immediate intubation during the initial examination, we carried out oral intubation under fluoroscopic guidance after giving a muscle relaxant and sedative drugs to avoid additional injury to the vessel by the kitchen knife before angiography. Right vertebral arterial angiography showed an occlusion of the right vertebral artery at the site of the knife edge. The radiologist and neurosurgeon co-performed transcatheter arterial embolization (TAE) at the site proximal to the injury of the right vertebral artery with a coil and 50% N-butyl-2-cyanoacrylate (Fig. 2). After the TAE, the patient underwent emergency surgery under general anesthesia, during which the kitchen knife was removed, and the skin incision was opened to the right and left of the knife wound (Fig. 3). The platysma and a part of the sternocleidomastoid muscle were ablated, and the right lobe of the thyroid gland was found to be injured. Active bleeding was not recognized at the point where the knife was removed. However, coagulated blood was found in the intramuscular space with edema. Hemostasis and tracheotomy were then carried out. The operation time was 1 h 44 min, and blood loss was 270 mL. The patient's Abbreviated Injury Scale was 3 for the neck and 2 for the extremities, her Injury Severity Score was 13, and the probability of survival was 43.8%. Her postoperative course included right upper extremity paralysis due to brachial plexus injury, and she was transferred to another hospital for rehabilitation on the 24th hospital day.

DISCUSSION

WE CHOSE TO reduce the potential for any further bleeding by arterial embolization before surgery because there was no active bleeding, the patient was in an exsanguinated condition on arrival to our hospital, and although her circulation was recovered by initial resuscitation with fluids, CT showed a vertebral artery injury.

Whether CT examination should be undertaken in unstable patients remains a controversial problem. Recently, however, hybrid emergency rooms have been introduced into the emergency department, whereby it is possible to safely carry out CT examinations in the resuscitation room.[4] If a hybrid emergency room is available, many treatment strategies are available.

Intubation was a very troubling problem in this case. There was danger that the intubation procedure would cause the kitchen knife to move. We thus chose oral intubation under X-ray fluoroscopy after giving a muscle relaxant and sedative drugs to avoid additional injury to the vessel by the kitchen knife.

Our patient suffered a right cerebellar stroke after the operation. We thought that the cause of the stroke was likely microthrombus formed in the distal vertebral artery near the knife and that a thrombus had travelled to the cerebellum before or at the time the kitchen knife was pulled out. This stroke was very small, and the patient did not show any symptoms.

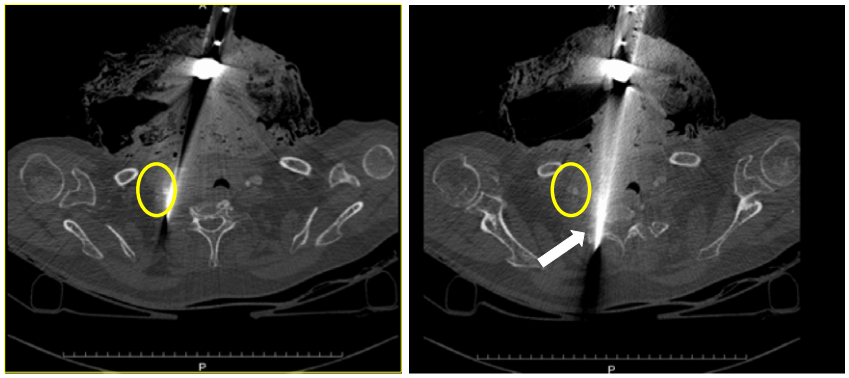

Fig. 1. Computed tomography of the neck of a 64-year-old woman who was stabbed in the middle side of the right neck with a large kitchen knife. The knife edge passed near the right common carotid artery and jugular vein (circle) and injured the right vertebral artery (arrow).

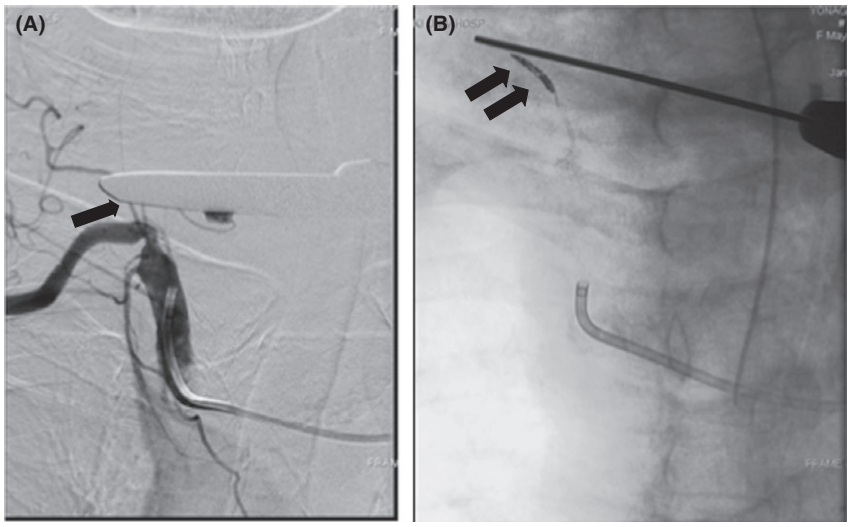

Fig. 2. Angiography of the right vertebral artery of a 64-year-old woman who was stabbed in the middle side of the right neck with a large kitchen knife. A, Disruption of the vertebral artery at the C7 level (arrow). B, Arterial embolization with a coil and 50% N-butyl-2-cyanoacrylate (two arrows).

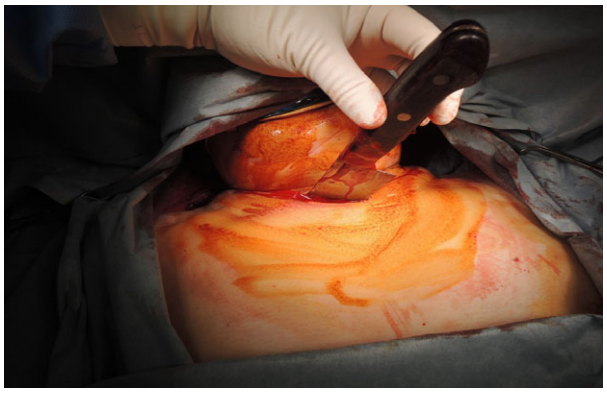

Fig. 3. Stab wound in the middle side of the right neck of a 64-year-old woman. The photograph shows the kitchen knife in place before surgery.

After the operation, however, she experienced obvious right arm paralysis due to nerve root injury. This symptom in her arm could not be explained by the cerebellar infarction. Neck magnetic resonance imaging was carried out, which indicated that the cause of the symptom was likely nerve root injury. This was thought to be a result of root ischemia due to embolization of the vertebral artery or direct injury.

The neck contains many vital structures such as the trachea, carotid and vertebral arteries, jugular veins, and esophagus. Therefore, neck trauma can be a life-threatening injury. In patients with neck injury, associated critical injuries must be detected to determine the proper treatment strategy that will reduce morbidity and mortality.

Two options are available for the treatment of bleeding from a vertebral artery injury: TAE and surgery. Surgery for the control of bleeding from an injured vertebral artery is difficult and challenges the surgeon's professional technique because the artery is hiding in the bony roof of the vertebrae.[5,6] In previous reports, bleeding was controlled by ligation[7] or by insertion of a Foley catheter balloon to create a tamponade effect.[6] However, ligation is a difficult technique because exploration of the proximal and distal transverse processes requires direct ligation of the intraosseous vertebral artery.[8]

In our patient, angiography and TAE before surgery resulted in an easy operative procedure and a small amount of bleeding. If active bleeding had been recognized from the distal end of the right vertebral artery at the point where the knife was removed, our plan for hemostasis was to provide a tamponade effect with the Foley catheter balloon. Furthermore, if occlusion of the right vertebral artery or internal carotid artery had been present, we would have also undertaken TAE to secure blood flow to the basilar artery through the circle of Willis. As a lesson from this case, interventional radiology with embolization can be effective and indicated for vertebral artery injuries in hemodynamically stable patients.

CONCLUSIONS

COMPUTED TOMOGRAPHY ANGIOGRAPHY for diagnosis and a treatment strategy incorporating

interventional radiology are useful for the management of penetrating neck trauma. Transcatheter arterial embolization for vertebral artery injury is safe and allows easy control of bleeding compared to a surgical procedure.

DISCLOSURES

Approval of the research protocol: N/A.
Informed consent (if applicable): Yes. We were obtained written informed consent for publication from the patient.
Registry and registration no. of the study/trial: N/A.
Animal studies (if applicable): N/A.
Conflict of interest: None.

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